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An Analysis of the South Carolina Forestry Commission's Physical Fitness Program and the Effect of Employee Bonuses on Participation and Results



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By Leslie Woodham

The South Carolina Forestry Commission (SCFC) was established in 1927 to "... take such action and afford such organized means as may be necessary to prevent, control and extinguish fires...". The South Carolina Forestry Commission is responsible for protecting 13.6 million acres from wildland fire; this includes 12.2 million acres of commercial forestland. The Forestry Commission has a statewide wildland fire prevention, detection and control network in place. Personnel are assigned throughout the state in a series of unit, regional, and headquarters offices. The largest single group of employees -wildland firefighters -report directly from their residences in responding to wildland fires. Forestry Commission dispatch is by closest available resource, regardless of political or administrative boundaries.

There are approximately 900 county, municipal, and volunteer fire departments in South Carolina. Most of these fire departments respond to wildland fires and control a large number of the wildland fires before they become destructive. The fire departments and the Forestry Commission work together to control wildland fires. Most of the fire departments are not equipped to control wildland fires that have burned beyond areas that can be reached from roads.

Forestry Commission firefighters respond to more than 4,000 wildland fires burning about 24,000 acres per year; 98% of the wildland fires are caused by human activities.

Description of Problem

The SCFC has never looked into what effect monetary bonuses (\$78,400 paid out '06-'07 fiscal year) have on the participation in, and effect on, the results of the physical fitness program. An incentive based program was adopted in 2004 "to help ensure that fireline employees who perform direct fireline activities (wildland firefighting and/or prescribed burning) are physically able to perform their duties safely and efficiently".

History of Program

Heart attacks continue to be a leading cause of death among wildland firefighters (22 percent of the total fatalities) according to a study done by the National Wildfire Coordinating Group from 1990-2006. A Forestry Commission task force was developed in early 2000 to help develop and implement a Physical Fitness Program for agency firefighters. Questionnaires were sent out to the NASF (National Association of State Foresters) and the U.S Forest Service. Input was sought from these offices concerning whether or not they had a physical fitness program and the details of such a program. From these it was determined that the best option was to adopt the Moderate Level Work Capacity Test as developed in 1998 by Dr. Brian Sharkey for the U.S. Forest Service. This test measures aerobic capacity, muscular strength, and muscular endurance. The test requires a 2 mile walk while carrying a 25 pound pack in 30 minutes or less.

The objectives of the Program are:

- To ensure the readiness of fireline employees to perform their jobs.
- To increase fireline employees' productivity.

- To increase physical fitness levels of fireline employees through a program of fitness and health education, evaluation, monitoring, and follow-up.

The Program should also produce the following positive benefits to the fireline employees:

- Decreased medical costs due to accidents and disease.
- Increased awareness of the importance of a healthy lifestyle to long-term health and happiness.
- Reduced risk factors for lifestyle-related conditions such as cardiovascular disease, hypertension, muscular skeletal problems, pulmonary disease, cancer, obesity, diabetes, depression, and other potential disabilities.
- Improved morale and self-concept.

Fireline employees have a duty and an obligation to be ready to respond to situations affecting the public's safety and property. A physically fit fireline employee can go from rest to exertion, can sustain that exertion, and recover from it safely. Unfit fireline employees cannot perform their jobs effectively or efficiently and in many wildfire and/or prescribed burning situations, unfit fireline employees are risks to themselves and to anyone they are protecting or with whom they are working.

Trauma patients, who are physically fit, have a higher probability of surviving any type of physical trauma. Heart attack victims who are physically fit have a greater survival rate than unfit people if they do develop cardiovascular disease.

One's tolerance to fatigue increases with physical fitness level. Physically fit people do not get as tired, and can work harder than unfit people. As a consequence, the

incidence of accidents and injuries decreases as fitness increases. Many accidents occur when people become fatigued and lose alertness.

In a confrontation situation, an unfit fireline employee's options are limited. The fit fireline employee has a broader response repertoire because of greater stamina, strength, and flexibility.

Many fireline tasks require sustained heavy activity. Getting tractors out of bogs, pulling winch cables, raking hand lines, and pulling hoses are a few examples of where high degrees of muscular and cardio-respiratory endurance are necessary. As one becomes more fit, one's physiological mechanisms for managing and handling stress are enhanced. A healthy, fit employee gets a fireline job done more quickly, which means before more lives and property are destroyed.

The program was begun in September 2001 with fireline employees walking 1 mile without a pack and a goal of 16 minutes or less. The consequences of not passing the first few tests were that you would come back and walk the next month. The 1 mile walk was administered 2 more times until in September 2002; the walk became 2 miles in 30 minutes or less without a pack. Again, there were 3 required walks for that year. The 25 pound packs were first worn in September, 2003. Employees were required to walk 1 mile with the pack in 15 minutes or less 3 times that year. Employees not finishing or finishing over the allotted time were required to come back and re-walk a month later. In July, 2004 it became mandatory for all new hired fireline employees to pass the moderate level walk (2 miles with 25 lbs pack in 30 minutes or less) as a condition of employment, and to continue to pass all future tests as a continuing condition of employment.

Employees hired prior to July 1, 2004 must participate in the moderate level test

and make a good faith effort to meet the time requirement. The first 2 mile walk with a pack was held in October, 2004. In December 2004 it was announced by the State Forester that the program would become an incentive based program. All employees that passed the 3 required walks during 2004 were rewarded with a \$300 bonus. Employees also have the option to take the "arduous" test which consists of walking 3 miles with a 45 pound pack in 45 minutes or less. Passing the Arduous Level Work Capacity Test along with the proper training will qualify South Carolina Forestry Commission employees for assignments requiring the arduous level of physical fitness. It will also exempt an employee from participating in the next scheduled moderate level test. In January, 2005 the bonuses for the walks were set as follows:

Passing the Arduous test	\$350 per test
Passing the moderate test	\$150 per test
Completing the test in over 30 minutes	\$100 per test

These rates are still in place today. At this time it was also announced that the walks would be cut down from the three walks per year to two.

Data Collected and Analyzed

Data was collected and analyzed from all the walks administered since the first walk in September 2001 until December 31, 2007. During this time 469 employees participated in a total of 4504 walks. Walk dates, distances walked, test results in minutes and seconds, and whether or not a participant finished the walk was noted. The results of the one and two mile walks without a pack as well as the one mile walks with a pack were not included in the final study as their could not be any correlation drawn between

these numbers and those of the “post bonus” walks. The table below shows the results of the moderate level conducted since the program was implemented.

Table 1.

	Number of Walks	Number Passing	Number Failing	Percent Passing	Number Not Finishing
2004	240	177	63	74%	10
2005	485	366	119	75%	20
2006	493	367	126	74%	30
2007	485	350	135	72%	44

A statistical analysis and the average time in minutes and seconds of those passing the tests was also calculated. Two –tailed hypothesis testing was performed to determine if the proportion of participants passing the moderate level walk test varied statistically from year to year.

	2004 Moderate Passing	Minutes	Seconds
		28	37
Mean			28.62391714
Standard Error			0.079977004
Median			28.9
Mode			29.5
Standard Deviation			1.064024829
Sample Variance			1.132148837
Kurtosis			0.081318744
Skewness			-0.9199172
Range			4.916666667
Minimum			25.06666667
Maximum			29.98333333
Sum			5066.433333
Count			177
Confidence Level (95.0%)			0.157837439

2005 Moderate Passing Minutes Seconds

	28	30
Mean		28.5007286
Standard Error		0.051422959
Median		28.59166667
Mode		29.83333333
Standard Deviation		0.983779135
Sample Variance		0.967821385
Kurtosis		-0.249320843
Skewness		-0.571381375
Range		4.783333333
Minimum		25.16666667
Maximum		29.95
Sum		10431.26667
Count		366
Confidence Level (95.0%)		0.101122332

	2006 Moderate Passing	Minutes	Seconds
		28	31
Mean			28.51144414
Standard Error			0.0597131
Median			28.75
Mode			29.5
Standard Deviation			1.143938436
Sample Variance			1.308595146
Kurtosis			4.010664683
Skewness			-0.553911029
Range			11.58333333
Minimum			23.5
Maximum			35.08333333
Sum			10463.7
Count			367
Confidence Level (95.0%)			0.117423932

	2007 Moderate Passing	Minutes	Seconds
		28	37
Mean			28.6237619
Standard Error			0.052453376
Median			28.83333333
Mode			29.83333333
Standard Deviation			0.981312806
Sample Variance			0.962974824
Kurtosis			0.499092569
Skewness			-0.920086426
Range			5.016666667
Minimum			24.96666667
Maximum			29.98333333
Sum			10018.31667
Count			350
Confidence Level (95.0%)			0.103164371

The number of employees working for the SCFC was also included to see if this influenced the results of the walks in any way. The numbers are:

2003 374 employees

2004 358 employees

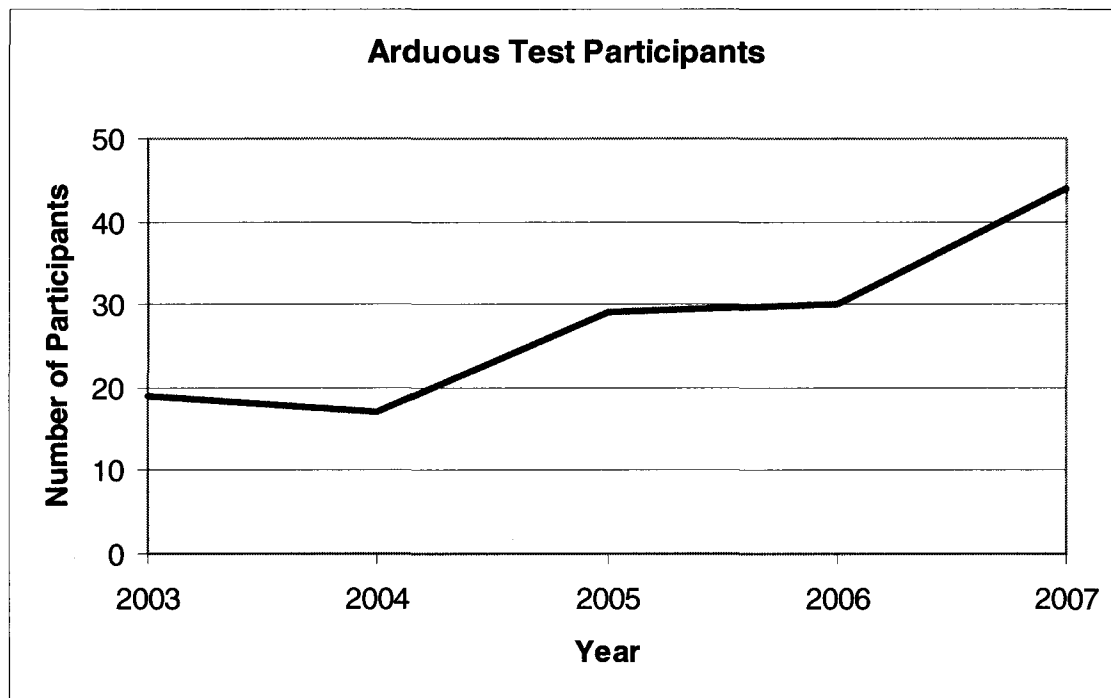
2005 365 employees

2006 359 employees

2007 367 employees

In addition an analysis of the Arduous Level Pack Test was also done. This is a voluntary test that is administered in January of each year and had 139 participants from 2003-2007. As you can see in Graph 1 participation in this elite test has more than doubled since the bonus plan was implemented in 2004.

Graph 1



Findings and Conclusions

The number of employees passing the moderate level tests does not seem to be influenced by the bonuses paid by the SC Forestry Commission when comparing the pre-bonus walks (2004) to the post-bonus walks (2005-2007). The percent passing has remained extremely consistent throughout the four years studied. The two-tailed hypothesis testing was performed to determine if the proportion of participants passing the walk test varied statistically from year to year. Results showed no statistical difference at the 95% confidence level. The number of Agency employees also does not seem to have any effect during the period studied due to very similar numbers. One negative noted in the study is that the percent of employees not finishing the test has more than doubled from 2004 (4%) to 9% in 2007. The most positive difference noted in this study is in the number of employees passing the arduous level pack test. Seventeen employees took and passed the test in 2004 before the bonus was announced and last year 44 employees participated and passed this test. The incentive based program was developed as a way to recognize the efforts of individual employees to accomplish goals that will enhance their safety on the job, their personal health and the safety of co-workers. I believe that the incentive based physical fitness program has had a positive influence on the SCFC wildland firefighter. Comments from employees have for the most part been positive concerning the program. In some areas, peer pressure has encouraged employees to get into better shape. All fireline employees are required to be in the program regardless of hire date. Because passing is not a requirement of all fireline employees, I feel that we are never going to have a voluntary 100% passing rate. According to the South Carolina Department of Health and Environmental Control, the

rates of overweight and obesity in S.C. are among the highest in the nation with 3 of 5 adults being overweight or obese. 55% of S.C. adults are either inactive or do not meet the minimum amount of physical activity for better health. The SCFC does seem to be in better shape than the general public, but without requiring a certain fitness level for all employees, you will always have some that will just do the minimum (participate).

An evaluation of the workplace injuries/illnesses rates occurring before and after the implementation of the program could be done to determine what the impact has been on these rates. One recommendation that I would make would be to have more of a discrepancy between the monetary amounts (currently \$50) paid for passing and for completing a walk. I believe this would push more of those that are currently completing the walks to start passing them.

References

Act of General Assembly, Title 48-Chapter 23-Section 90; General Duties of Commission.

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National Wildfire Coordinating Group, PMS 841- Wildland Firefighter Fatalities in the United States.

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